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Title of the Paper: **Non-linearity of Urban Expansion: Transition to Sustainability**

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Abstract

This paper presents the dynamics of housing expansion as a non linear emergent process that begin as separate individual local decisions which determine the patterns of area growth, sprawl, and emerging land use patterns, taking an intermediate city, Seremban Municipal Council (MPS) in Negeri Sembilan, Malaysia as a case study. There is still much to study about how housing neighborhoods are formed and then evolve, how we might best understand and then simulate them, and most importantly, how we should design plans which enable them to function in more efficient and sustainable ways. The population of the urban areas grows, and influence the physical expansion of housing that in turn influences the expansion of the urban areas even to the extent of going beyond their legal administrative boundaries engulfing the once isolated villages (*kampungs*) into huge urban areas. The inter-relationship and inter-connection between *state, market and society* need to be articulated from a bottom-up approach to understand the housing dynamics in this area as well as in Malaysia as a whole. Although, longer time series information is needed to understand the dynamics of the housing development, the present study is still beneficial for future urban development in the State. The vibrant housing development in the city is most welcome to generate the needed economic opportunities for the developers, prospective owners and buyers, and the government as well as the financial and legal institutions. A new decision making approach of governance is needed to govern the dynamics of housing development to develop a better resiliency of the city community. All of these call for planning concerns at the regional scale responding to change due to global conditions. It is argued that in the future, housing development needs to be planned based on this type of non-linearity.

Keywords: Non-linearity, urban expansion, complexity, sustainability

INTRODUCTION

The urban habitat changes within a very complex environment. Multiple activities that take place spatially and temporally in the urban habitat make the city dynamic and vibrant, and difficult to predict. The interactions between the components in the urban habitat need to be understood well to come to grip with the sustainability of the habitat. This paper argues this dynamics evolve in a non-linear form rather than the more predictable linear growth assumed in traditional land use models. It discusses the idea of housing and neighborhood expansion that begins as separate individual local decisions which determine the patterns of growth, sprawl, and emerging land use patterns, taking an intermediate city, Seremban Municipal Council (MPS) in Negeri Sembilan, Malaysia as a case study.

The assumption of this paper is that the thinking behind planning for urbanization is always linear. It is then applied to the place that the planners want developed. The idea to build housing areas is based on the current total and projected population of the city areas and the available infrastructures. The documents such as the National Physical Plan, the Structure Plan, and the Local Plan are based on the linear thinking of planning. During the implementation stage of the housing project, the planning documents are referred to. However, there are other factors that may interfere at the subsequent stages project development. These include economic growth, uncertainties due to globalization and others. In the real economic world, the development of housing projects follows multi-path dependent and complexity of evidence.

Integrating Sustainability Science into Housing Livability Research

Sustainable development is a normative political concept, a vision of the desired evolution of society. There is a need to develop the so called the “new science” to understanding and to manage the issues related to sustainable development well. The concept of sustainable development is more than “sustainability”. While sustainability is frequently understood as durability in terms of program implementation, sustainable development implies a paradigm shift from a model of development based on inequity and exploitation of resources to one that requires new forms of responsibility, solidarity and accountability not only at the national but also at the global level. Sustainable development requires also the integration of the economic, social and environmental pillars. Such an integration calls for a new science which since 2000 has emerged in the form of sustainability science; it has been propagated as a new multidisciplinary field of research. This science refers to the service it renders to sustainable development (Clark and Dickson 2003). Kates et al (2001) coined a term ‘sustainability science’ to refer to a new science that provides a theoretical underpinning for a research related to sustainable development with a seven core questions, and later Swart et al (2004) added another important core question.

The nature of housing expansion involves many overlapping factors. A multi disciplinary approach may allow one to come to grip with its nature. Thus, urban uses sprawl into the agricultural area on the fringes of the city engulfing small villages along the way into the forest areas if not stopped. In the study area, since the 1970 housing neighborhoods had sprung up at a rate never seen before, moving out at first from the main established cities and towns to the periphery and later on to the rural-urban fringes. New towns were also set up to meet the demands from new manufacturing industries and their workers, and subsequently later on the commercial establishments. The ease of mobility following the construction of highways and good connecting roads supported by private car ownership policy had

promoted the growth of sprawling urbanized areas along roads and in areas close to the highways. Over the years we have witnessed that traditional villages which were isolated from one another and from the towns and cities are being engulfed into the urbanization spread.

Traditional villages close to the main cities and towns provide shelters to those who commute daily to the cities and towns. Such villages may still carry some traditional self sufficient activities but for most villages within 30 kilometers from the city their inhabitants have undergone changes to an urban way of day to day living.

By 2050, approximately 60% of the world population (estimated at 9 billions) will live in urban areas. At that date about 80 % of the Malaysians (estimated 35 millions) will be urban dwellers. At present (2010) about 62 % of the 28 million people are already in urban areas. Such scenario calls for better planned urban areas, towns and cities to cope with the increasing demands for better living conditions. The increasing complex issues faced by all urban areas require a deeper understanding of the processes at the community level. For that purpose our research into urban complexity issues for the last seven years has attempted to integrate sustainability science into housing livability studies. Using ideas from complexity thinking the research aims to evaluate the sustainability and livability of urbanization in the Seremban Municipality Council (MPS) that is located in Negeri Sembilan, Malaysia. For this paper, we use 'housing area expansion' as a representation of urban spatial development.

LINEAR THINKING IN PLANNING

Linear thinking in planning has been manifested through both physical design and mathematical models used to explain the city. Population and economic growth projections often assume linear trends that are then used to underlie planning decisions for facilities provision. Mathematical models that inform planning are also often based on general linear models. Earlier gravity and locational choice models often assume linearity in their solution. Only recently has modeling moved to take into consideration non-linear relationships (for examples see Batty 2005; Batty 2006). In extension, the linear city model that stressed development along main transportation arteries is a design that assumed spatial linearity of growth and design the city in a linear growth manner. Examples of such a design began with Arturo Soria Mata, to ideas by Corbusier, Peter Eisenmann, Michael Graves and the current Linear City project in Hong King. Within the planning process, the standards approach also assumes linearity in growth and provision of public services. While these approaches have been useful in assisting planning in the past, current phenomena of growth are hampered by a continued adherence to the linearity assumption. An implication of such linearity is the top down structure of planning. Linearity is much easier to assume given a very controlled approach to planning. Today's bottom up participatory approach is more open and uncertain, leading to increased non linear patterns of development.

SEEDS OF HOUSING GROWTH

The classical view of housing as a service to basic economic activities such as manufacturing (see for example Heilbrun, 1981) infer that the spatial pattern of housing growth is due to the location of economic activities. While this was the case in a spatially confined economic growth, current development trends, especially that of transportation and the clustering of economic activities, have extended the interaction space between landuses and resulted in a different basis for housing expansion. Housing projects are built spatially further away from

economic hubs and seem to draw their residence from all over the place, even outside the region. Housing construction at times seem even to precede basic economic activities for the area. In Malaysia large housing projects sprung up all over the place in a seemingly random pattern resulting in sprawl that challenged the service providing capabilities of local authorities. While there are many land economic variables that contribute to the location of these housing projects the paper argues that the pattern of housing proliferation is also due to earlier local settlements that serve as seeds for the growth of the housing sector. In the case of Malaysia traditional Malay villages, the New Villages of the communist insurgency era of the 1950s, plantation communities, among others, all serve as these seeds. The paper explores this explanation of housing growth to partially explain the seemingly random growth of housing projects that led to sprawl and unsustainability.

HOUSING EXPANSION, DATA GATHERING AND METHODS

A basic difficulty faced in conducting the present study is the absence of population and housing data at the community level covering more than a century. Such long term time series data would provide the much needed information to show the behavior of housing expansion in the focus municipality. In the circumstance, spatial and time series data have to be derived from several official documents and records, surveys and in-depth interviews within the study area to unravel the progress of housing development and neighborhood expansion for the past 200 years. Several proxies were used, which were then divided into four categories. These categories are; religious institutions such as mosques, churches; academic institutions such as schools, *madrasah* (religious school); housing estates and settlements. The housing estates boundaries were demarcated based on a map from the MPS and the Survey Department of Malaysia, by determining the edge of each estate.

These proxies were used with the assumption that all the elements such as the religious and academic institutions indicate that there must be human settlements in the surrounding areas, and from them one can determine too the community residing in the surrounding area. One can also work out the dominant community in the area. These data were then analysed spatially using a Geographic Information Systems.

THE DYNAMICS OF HOUSING EXPANSION – THE SEEDS OF EXPANSION AND THE FUTURE DIRECTION

The housing expansion in the study was grouped according to three phases of urbanization in Malaysia, namely the Nascent Urbanisation phase; Pseudo-Urbanisation and the extended Mega Urban Region phase (Abdul Samad Hadi et al 2010a; Abdul Samad Hadi et al 2010b). They argue that the Malaysian urbanization experiences have progressed from nascent urbanization when a hierarchy of modern Malaysian urban centres were gradually developed by the British colonial administration, effectively as from the beginning of the nineteenth century when Pearl of the Orient (Georgetown), Melaka (much earlier), Labuan and Singapore were founded. The second phase is the era of the pseudo urbanization articulated by Terry McGee (1971) in his seminal paper that argued for a different urbanization experience path taken by the third world societies from that of the western world. The third phase is about the rising mega urban regions, never experienced by the country before but certainly making strong impacts on the Malaysian urbanization landscape at the moment. These mega urban regions are part of the Malaysian society's bid for modernity and advancement, and a first world status by 2020 or thereabout.

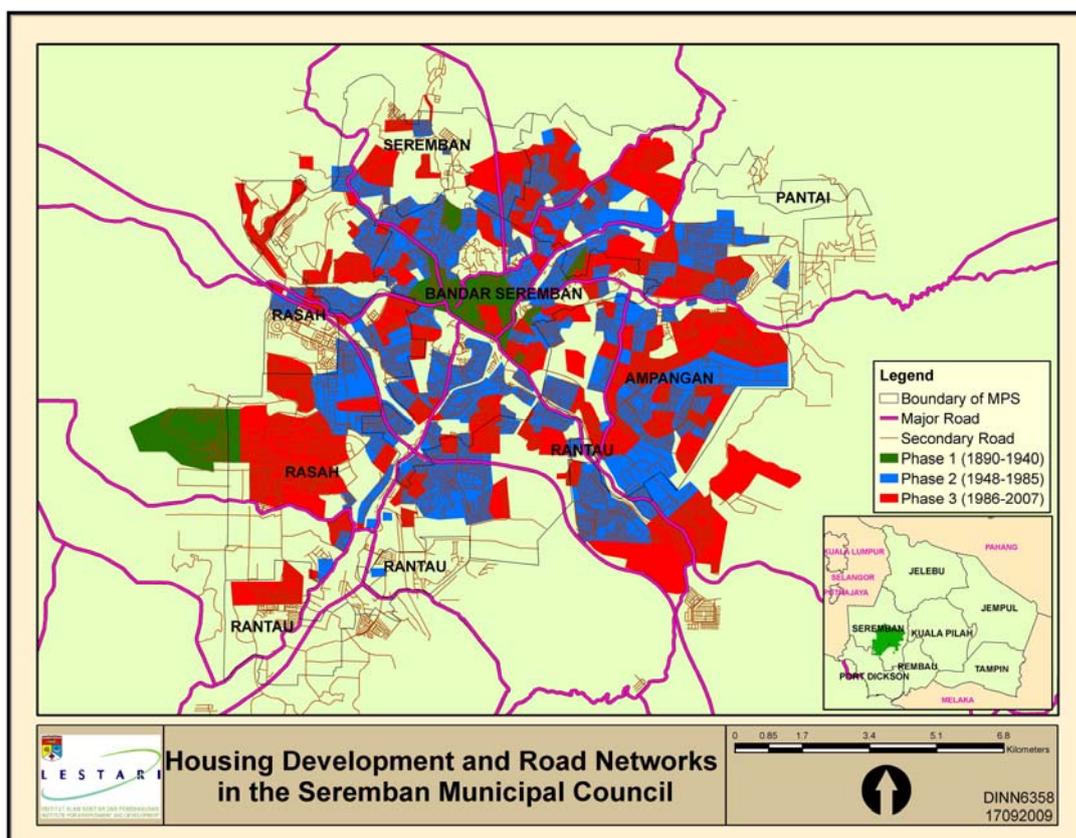


Figure 1: Three phases of housing expansion in the Seremban Municipality Area

In the first phase the housing expansion was seen to be more concentrated in the city centre and a few traditional areas in Ampangan, Rasah and Pantai for security reason and the need to minimize mobility following the limited transport infrastructure during the formative stage of the city around the late 19th century. The patterns persisted in the second urbanization phase through out the decades of the twenty century until Malaysia attained its Independence, albeit some changes had taken place within the housing neighborhoods. But by and large there seemed to be no new large housing neighborhoods were developed over those decades. Some smaller housing projects were developed close to the existing housing neighborhoods in the early Independent years, 1957-1969, that is in phase 2 of the urbanization process in the country.

Housing development in the phase three of the Malaysian urbanization was vibrant. For the years 1971-1975 there was the tendency that housing development was closely related to accessibility to main transport arteries. Housing development seemed to be in close association with road development, especially housing development proceeding southward on the city. The relation between road development and spatial expansion of housing area in Seremban is shown in Figure 1 all housing areas are located close to main road networks.

In the last three decades, housing development has been active; housing projects were pursued in large number partly in response to a boom property market, the State government's policy of attracting people to stay in Seremban but work in Kuala Lumpur and the vibrant Klang valley conurbation. The distance between Seremban and Kuala Lumpur is

approximately 70 km or about 40 minutes traveling on the highway. Apart from those the authorities had upgraded dated facilities and amenities, and constructed more road networks within the city, state of the arts physical, social and some green infrastructures. A major attraction to housing developers in the study area is the availability of lands at a reasonable or cheaper rate.

Overall, the state government policy which encourages the people to stay in Seremban and work in the Klang Valley also assists further in accelerating housing development in this area. Hence, the future of the housing development will sustain for as long as the economy maintains its vibrancy.

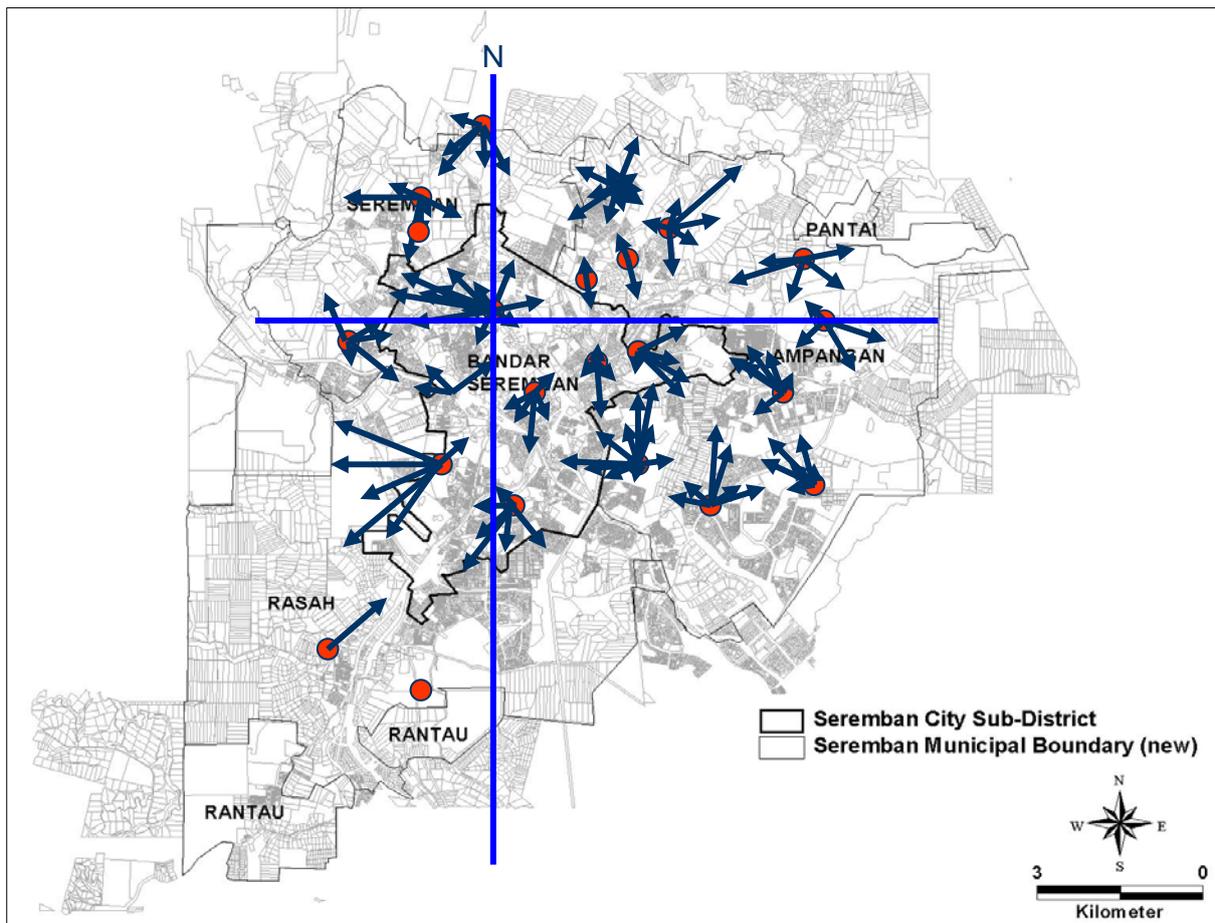


Figure 2: The Seeds of the Housing Expansion in Seremban Municipality Area

Figure 2 above shows housing expansions from housing seeds distributed all over the city area. Table 1 below lists the number of seeds from which housing expands in the Seremban Municipality area for the past 200 years. There are 22 seeds grouped into the three phases of urbanization in Malaysia from which housing areas in the city grew over the years. It is clear from the diagram that the housing areas do not expand in a linear fashion from the city centre outward to the periphery. Rather, the seeds have shown that the housing expansion in the city has been more complex than at first thought.

Table 1: Number of Housing Seeds

Phases of Urbanisation	Number of Seeds	Seeds Locality
Nascent Urbanisation 1511 – 1947	7	<ul style="list-style-type: none"> • Seremban City Centre (Sekolah ACS, KGV, St Paul)
Pseudo Urbanisation 1948-1970	2	<ul style="list-style-type: none"> • Paroi New Village
Extended Mega Urban Region Urbanisation 1971- current	13	<ul style="list-style-type: none"> • Panchor • Tun Dr Ismail Industrial Area • Sikamat • Taman Pinang Gading • Megaway • Temiang New Village • Taman Chip Aik • Taman Bukit Kaya • Kem Tentera • Taman Bukit Tembok • Bukit Kepayang • Taman Seri Mambau • Taman Angsamias • Rasah • Rahang • Senawang • Army Camp • Kg Dusun Nyior • Kg Gedong Lalang • Kg Paroi

IMPLICATIONS TO HOUSING AND URBAN PLANNING FOR THE FUTURE

The results show that housing development and expansion for the past almost 200 hundreds years in Seremban was not as linear as we had expected. The interrelationship and interconnection between the components need to be understood well. Therefore, the bottom-up approach in studying the housing expansion is needed to understand the housing dynamic in this area as well as in Malaysia as a whole. Although, a longer time series data are needed to understand the dynamics of the housing development, what have been shown here is beneficial for future urban development and urban sustainability planning in the State and the country?

The vibrant housing development is important in helping to generate the needed economic attractions to the housing developers, the finance and legal institutions in the city, the prospective house buyers and the local and State governments. A new approach of governance is needed to govern the dynamics of housing development. The need for effective housing planning using ecological and complexity perspective and approach will worth a try.

That the population of the urban areas grew and went to influence the physical expansion of housing that in turn indicates the expansion of the urban areas to go beyond their legal administrative boundaries engulfing the once isolated kampungs into huge urban areas is there on the landscape for all to view. There is a need to look into the role of the individuals,

the families and the local urban communities in shaping the housing growth patterns in the urban regions; specifically how the people at the local level influence the physical growth and expansion of the urban areas within the established planning requirements of the country. This study is an attempt to look at the urbanization process from below that is the local community; embedded in this is the idea of city complexity that our study group sets to examine: that city complexity will determine the nature of city livability and its sustainability, influencing its governing process and planning for the coming years.

This paper offer a new approaches to societal decision making, better understanding of society's interface between services, demands, and behaviour of society's. Examining city expansion with housing development and growth as a representation of decision making at the lower layer than the whole city landscape provides new insight of contributed to the growing housing areas. The city authority must have seen the applications and the plan from the developers who much earlier have secured suitable vacant lands for housing. On receiving approval the developers will get the financial backing, and then get the contractors to execute all kinds of work from actual building to wiring, piping and so on. The marketing parts get all the necessary information about the housing area to the possible buyers who in turn search for loans.

How do we govern a resilient housing neighbourhood? Who is to do what to ensure that the housing area is able to function, to handle the complex issues and finally to move the urban areas for the benefits of its population and the country as a whole. The options are either to go on status quo with the cities, municipalities, townships and urban areas to go on to manage as usual. The other options are to change the management style - to develop new partnerships between the people, the public and the private organisations, and the non governmental organisations to manage the region, or the final option of developing an entirely new governance structure. The research group has gone to look at the combinations of these options to argue for a more entrepreneurial approach to governing the urban region.

CONCLUSION

The perspective taken to look at a phenomenon often shapes the understanding and response to the phenomenon itself. Studies in urban growth have traditionally viewed change via a linear lens. This was partly due to the limited analytical tools available as well as the simplification process in abstracting from the phenomenon. The linear approach has provided many explanations for urban expansion that resulted in the current understanding of a city's evolution. No urban analyst worth his or her salt would disagree that urban expansion is seldom, if ever, linear in form. The complexities of relationships that lead to any expansion are often lag ridden and imbalanced, weighted differently given local and global contexts. These alone are reasons for non linearity. Yet the worth of any model is its ability to provide a structure given a known abstraction process that is purposefully simplified. Von Thunen's agricultural rings, Alonso's urban land market and Christallers hexagons are early examples the linear land use growth models followed by Burgess's concentric circles, Hoyts' sectoral expansions and Harris-Ulmann's polycentric urban growth model. All provided valuable insights into the urbanization scene. Yet these early models also allow for modifications that have led to various other patterns. The complexity's approach of non linearity provide the latest pictures on the urbanization process and applied to not merely spatial growth but sustainable growth, it provides insights to future governance and planning of the city. Thus urbanization is no longer seen only as a description of physical change but also a change in meeting the optativeness of development. Placed within the sustainability science framework,

the non linearity approach to urbanization provide a new understanding on local drivers that come together to evoke societal change.

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